

FORWARD LOOKING COST STUDY AVERAGE COST PER LINE

<u>State</u>	<u>COSA</u>	<u>Company Name</u>	
IL	GAIL	Verizon Illinois (summary GTE)	\$49.26
IN	GAIN	Verizon Indiana (summary GTE/Contel)	\$57.70
MI	GAMI	Verizon Michigan (summary GTE/Contel)	\$45.93
MO	COMT	Verizon Missouri (summary Contel)	\$47.37
PA	COPT	Verizon Pennsylvania (summary Contel)	\$66.97
SC	GTST	Verizon So. Carolina (summary GTE/Contel)	\$36.87
CA	GTCA	Verizon California Inc.	\$34.30
CA	COCA	Verizon California Inc.	\$77.58
NV	CONV	Verizon California Inc.	\$54.04
FL	GTFL	Verizon Florida Inc.	\$32.29
HI	GTHI	Verizon Hawaii Inc.	\$57.08
MO	GTMO	Verizon Midwest Inc.	\$36.88
OH	GTOH	Verizon North Inc.	\$43.69
PA	GTPA	Verizon North Inc.	\$45.22
WI	GTWI	Verizon North Inc.	\$45.67
IL	COIL	Verizon North Inc.	\$41.10
IN	COIN	Verizon North Inc.	\$57.32
ID	GTID	Verizon Northwest Inc.	\$47.82
OR	GTOR	Verizon Northwest Inc.	\$40.73
WA	GTWA	Verizon Northwest Inc.	\$37.97
WA	COWA	Verizon Northwest Inc.	\$63.14
AL	GTAL	Verizon South Alabama Inc.	\$51.25
KY	GTKY	Verizon South Inc.	\$41.62
NC	GTNC	Verizon South Carolina Inc.	\$33.73
VA	GTVA	Verizon South Inc.	\$51.42
KY	COKY	Verizon South Inc.	\$79.30
NC	CONC	Verizon South Inc.	\$70.27
VA	COVA	Verizon South Inc.	\$38.96
TX	GTTX	Verizon Southwest Inc.	\$34.95
TX	COTX	Verizon Southwest Inc.	\$73.61
AL	COAL	Verizon South Inc.	\$69.00
<u>State</u>	<u>COSA</u>	<u>Company Name</u>	
DC	CDDC	Verizon Washington DC Inc.	\$24.18
MD	CMMD	Verizon Maryland Inc.	\$28.33
VA	CVVA	Verizon Virginia Inc.	\$30.19
WV	CWWV	Verizon West Virginia Inc.	\$49.56
NJ	NJNJ	Verizon New Jersey Inc.	\$29.31
PA	PAPA	Verizon Pennsylvania Inc.	\$33.78
DE	DSDE	Verizon Delaware Inc.	\$24.02
NY/NE	NXTR	Verizon New York/New England	\$24.96

Description of Forward-Looking Cost Study Methodologies

Verizon used three models to calculate the forward-looking cost of residential voice grade access to the public switched telephone network, depending on the model that is used in each region for state and federal proceedings. The architecture, technology, and equipment assumed in these models and these cost studies represent the most efficient technology that Verizon is deploying for a network having the scale, scope and characteristics of Verizon's network. For these studies, Verizon used the Loop Cost Analysis Model ("LCAM") for Verizon New England (except ME and NH) and Verizon South; the Integrated Cost Model ("ICM") for Verizon West; and the Link Cost Model ("LCM") for Verizon New York, ME and NH. The costs for residential voice grade service are derived primarily from the loop and port cost components of these models. A description for each of the cost models is provided below.

Cost Model Inputs and Assumptions

The Verizon cost models require some corporate and company-specific inputs. One example of a corporate level input is the cost of capital. In these forward looking cost studies, Verizon used its actual current cost of raising capital through debt and equity sources. Depreciation lives are an example of inputs that vary by study area. These cost studies utilize GAAP depreciation lives. In addition, all retail costs for marketing, customer service and support, and billing expenses have been included.

Utilization factors, also called fill factors, are used to load the cost of unused capacity onto those units of capacity which generate revenues. Capacity cost studies typically divide the investment for equipment by the total capacity of the equipment, to develop a unit investment. The unit investment is then divided by the utilization factor to arrive at a utilization unit

investment. For these costs, the actual fill for each state was applied. The actual fill factor is based on the total working pairs and the total available pairs. Specific fill factors are developed for feeder, distribution, loop electronics, conduit and interoffice facility electronics. The model also adds in the common overhead costs on a per-line basis to produce the forward looking average cost per line for each study area.

The Loop Cost Analysis Model

The Loop Cost Analysis Model (“LCAM”) is designed to develop the investments and costs associated with the local loop. LCAM derives its loop plant characteristics from a survey of feeder route data conducted by Verizon engineers. LCAM has three study modules: Plant Characteristics, Electronics and Loop Study. It also has a documentation module that generates reports, inventories the source documents, and organizes the study.

The Plant Characteristics module, which looks at average lengths of segments of the network, is derived from the Ultimate Allocation Area Analysis (“UAAA”) model. That is, the physical characteristics of the Outside Plant Network are obtained from the respective engineering group for geographic subdivisions of the wire center. These areas are identified as Ultimate Allocation Areas (“UAA”s) or Distribution Areas (“DA”s), where UAAs consist of one or more DAs. A mechanized report of actual working and available lines in each DA is obtained from Loop Engineering Assignment Data (“LEAD”), and these data are assigned to the appropriate UAA, if required. The Plant Characteristics module computes the feeder, sub-feeder and distribution length and structure for each DA or UAA. The investment per pair-foot is derived from the cable sizes and investment data derived from Vintage Retirement Unit Costs (“VRUC”) or the Engineering Cost Record Information System (“ECRIS”), as available. These

results are weighted by working lines in the selected services, and are summarized by wire center.

The Electronics module analyzes the total working lines by DA or Carrier Serving Area (“CSA”) to identify the appropriate size and investment for Digital Loop Carrier (“DLC”). If CSAs have not been identified by the Engineering organization, the UAA may be used as a surrogate. From these details, a weighted average DLC investment is determined for each wire center.

The Loop Study module reads the summarized results of the Plant Characteristics and Electronics studies and various other factors. These values are used to compute loop costs for the available architectures for each wire center and weight them to produce a composite loop cost.

In the Plant Characteristics module, the basic level of data is the ultimate allocation area, which is a subdivision of the wire center. The UAA can be anywhere from a few hundred to a couple thousand lines, but it is not the whole wire center. There may be anywhere from 20 to 150 UAAs within a given wire center.

The first level of the plant characteristics analysis is performed for each and every UAA in the wire center, and that is written out to the UAAA results table. Then there is a second set of formulas that sum up the data and operate on those results in order to generate wire center level averages.

The Electronics Module works similarly. Each UAA is analyzed. Those results are written out, and the aggregation formulas sum and average those numbers.

The Plant Characteristics and Electronics outcomes go into the Loop Study, which is completely performed at the wire center level. The Loop Study results are written out for each wire center, and then in the documentation module, weighted averages are used to combine them into jurisdiction-wide averages.

There are two primary constructs for the physical characteristics of the outside plant in the engineering assumptions. One of them has two possible ways of being built. The first construct is distributed plant where cable is placed to reach each and every customer. This is often used where there are relatively small line count customers who are distributed through a neighborhood. If it is under the break point that the engineers have selected for economic reasons, they will place an all copper loop: copper feeder cable, copper sub-feeder cable, copper distribution cable, copper drop wire, no electronics.

The second distributed plant implementation is for those lines that are over the break point for a loop with next-generation digital loop carrier (“NGDLC”) serving Carrier Serving Areas (“CSA”s). The NGDLC comprises electronics (a central office terminal (“COT”) and a remote terminal (“RT”)) that are connected by fiber cable. At the field end the fiber transport is converted back to copper. At that point there is copper sub-feeder cable going to a cross-connect interface and then copper distribution cable leading to the customer.

The second major construct is fiber to the premises. Regardless of the distance, we will place the NGDLC RT at the customer’s premises and the COT at the central office. This construct is used to serve buildings of any loop length provided they are above a certain threshold of working lines. In this case, the feeder, sub-feeder, and distribution cable are all fiber with electronics are at each end.

The Engineering network survey is one of the key inputs to the model. It will tell how to get back to the central office through other UAAs, called Prior UAA's ("PUAA"), building a chain of PUAA's. The survey identifies the cumulative feeder distance, the total distance out to the UAA, the sub-feeder distance, the total loop length, the predominant feeder size in the last segment getting to the UAA and structure in that segment, and the predominant structure in the distribution, and the number of distribution areas in the UAA.

Another critical input in the Plant Characteristics module is the cable investment data. These investments are developed from vintage retirement unit cost data, which is an accounting system that tracks cable investments by size, by gauge, by account, and year placed or ECRIS, which is a system designed to automate the pricing, scheduling, tracking and construction management activities of outside plant projects. Loaded into the cable prices in the LCAM module are data on the SAI investments as well as the VRUC/ECRIS data that includes terminals, drops, and NIDs. Copper cable price is expressed algebraically in a slope and intercept form, allowing the model to create or interpolate a cost for any cable size. The costs for each size per sheath foot of fiber cable investment are input with Engineering selections determining the appropriate size for any given UAA.

One of the major assumptions in the Plant Characteristics module is that each UAA is treated as a sample loop. This module combines the specific characteristics of each UAA, including the cable size for feeder and distribution, the length of feeder and distribution, the percent aerial, buried, and underground for cable, to compute investments per pair-foot for the copper cables. The characteristics of all of the UAAs are weighted by the number of lines in each UAA to produce an average loop characteristic for the wire center.

With respect to the Electronics Module, digital loop carrier electronic investments are developed from vendor prices for each of the available sizes, assuming a bi-directional add-drop configuration that allows one central office terminal to serve up to a maximum of five remote terminals on two sets of fibers. This is provided that the demand in a given route does not exhaust the capacity before attaining five remote terminals. Although the common plug-ins that are required are added in this module, the channelizing plug-ins are added in the loop study module.

The Electronics Module calculates a unit investment for the RTs, universal COTs and integrated COTs by taking the hardwired and common plug-in investments for each and dividing by capacity. Then the electronics module looks at each and every UAA. It determines, based on the breakpoint, whether digital loop carrier will be required in that UAA. If so, it determines the appropriate size, determines the investment for that size, and multiplies it out by the total capacity, not just the number of working lines. For the fiber to the premises construct, the average investment for premises RTs is calculated based on size and percentage of lines. Then, in the aggregation routine, the model sums those investments for the wire center and divides by the total capacity to develop a weighted average investment. The average line capacity of a fiber strand is also calculated.

Finally, the Loop Study module uses the outputs from the Plant Characteristics module and the outputs from the Electronics module along with some other inputs (*e.g.*, fills, cost factors from VCOST, and pole and conduit investments) to calculate the investment per line for each wire center. The digital loop carrier plug-in investments specific to the service are then added, resulting, for example, in a different value for a two-wire loop versus a DS1 loop. Loops that are on copper feeder or on universal digital loop carrier also require the main distributing frame at

the central office, which is also added in this module. Investments for poles based on the fiber and copper cable, conduit based on fiber and copper cable investment, and the land and buildings based on the electronics are calculated.

The results of the Loop Study are the investments and costs by wire center. They can be aggregated through the reports into density cell and jurisdiction results. The loop investments can also be exhibited by plant account, if needed.

Loop costs are developed using forward looking economic assumptions appropriate for the loop network. Consistent with forward looking engineering guidelines, the loops reflect copper or fiber optic feeder cable (based on the copper/fiber breakpoint), copper or fiber distribution cable, Digital Loop Carrier and other electronic equipment.

The model converts these investments and central office termination (switch port) investments to a monthly cost per loop by multiplying by the annual charge factors and dividing by twelve to produce the average cost per line.

Integrated Cost Model (ICM)

1. Introduction

The Integrated Cost Model (ICM) calculates the cost of the single line residence loop and port. ICM integrates modules for each of the major network components. The model reflects Verizon's engineering standards, the technologies Verizon is using now and going forward, and Verizon's data and network topology. The resulting cost estimates represent the forward-looking costs for Verizon.

ICM calculates cost estimates for Verizon's basic network functions (BNFs), including costs related to the loop, switching, transport and signaling portions of the network. Cost study inputs, intermediate results, and outputs are presented in tables that can be viewed or printed. ICM develops costs estimates related to engineering, installing, and maintaining a modern digital network required to provide efficient telephone service in Verizon's service areas. Economically efficient, forward-looking technology is modeled. For example, the loop is designed to use fiber optic cable and pair gain devices, where appropriate.

The Loop and Switch modules develop the investments for network components and the Expense Module identifies non-capitalized labor costs such as billing, repair and service assurance. The Mapping/Report Module calculates the monthly expenses, combines the network components into services and produces output reports.

The Loop Module develops investments for network interface devices (NIDs), drops, distribution cable, terminals, cross connect boxes, pair gain devices, feeder cable, and related support structures. The Switch Module develops the investment for setup and minutes of use for each type of call path, for switched features, and line and trunk terminations. A further description for each of these modules is provided below.

2. Loop Module Design

The foundation of the ICM Loop Module is based on four items. These items ensure that the Loop Module is sensitive to the demand characteristics of each area being modeled, and that the results of the module accurately estimate the cost of providing service. The four items are: uniform demand units, an Electronic Serving Area (ESA) development, a local loop network design, and detailed engineering at all levels.

The Uniform Demand Unit is a standard $1/200^{\text{th}}$ degree by $1/200^{\text{th}}$ degree area that contains detailed demand, infrastructure, and topographical information needed to accurately design a telephone network. The unit, depending on latitude, encompasses an area of roughly 1500-by-1800-foot or about 60 acres.

The next item is the Loop Module's Electronic Serving Area (ESA) development. An ESA is an area in which all customers have access to a loop capable of providing digital services. The K-mean clustering algorithm was chosen as the mechanism for developing ESAs because of its speed, flexibility, and ease of understanding how the results were developed.

The third item is the Loop Module's Local Loop Network Design. ICM uses a Constrained Minimum Spanning Tree (CMST) Algorithm patterned after the Spanning Tree routine used by the Federal Communication Commission's (FCC's) Hybrid Cost Proxy Model (HCPM). This algorithm is used to develop the feeder network connecting the pair gain devices and the backbone network that connects the demand units within a cluster. Templates define the distribution network within a demand unit.

The final item is the Detailed Engineering contained in the Loop Module. ICM uses a variety of detailed engineering procedures to provide logical determinations of network characteristics such as structure type and size, placement type, material types and sizes, and labor costs.

3. Switch Module

The ICM Switch Module extracts the relevant unit investment (central office termination) for each host switch and remotes switch in Verizon's network. These investments are then made state specific, where appropriate, by applying a factor to the element to gross them up for power

and test equipment investment and EF&I (Engineered, Furnished, and Installed) costs. The expenses associated with the central office termination (switch port)are developed in the Expense Module. The Mapping/Report Module converts the central office termination investment into a monthly cost.

4. Expense Module

The Expense Module of the ICM is designed to develop:

- (1) *Capital Cost factors* used to convert the investments developed in the Loop and Switch modules into annual expense amounts.
- (2) *Operating Expenses* that are associated with the ICM modeled network investment components.
- (3) *Shared Costs*, a component of operating expenses, that are in direct support of and can be associated with multiple parts of the network or groups of services, but that can not be directly associated with a specific element of the network.
- (4) *Common Costs* that are incurred in support of all products, services and network elements but are not directly attributable to the provision of a specific product, service.

The loop and central office termination unit investments together with the expense factors are then used to calculate the average cost per line for each study area.

Link Cost Model

The Link Cost Model (“LCM”) is a forward looking costing model based on a “survey” conducted by Design Engineers, who were asked to re-design the existing network. This re-design is on a forward-looking basis of 242 feeder routes chosen in a random sample of 55 Wire Centers throughout the state. In designing the model, two forward-looking architectures were used. In the first, fiber feeder cable runs from the CO to the RT, and copper sub-feeder connects the RT to the SAI. Copper distribution facilities run from the SAI to the customer’s serving terminal. In the second architecture, fiber cable runs directly from the CO to the customer’s premises.

The link cost calculator has a number of inputs that it uses to cost out and develop a cost study. The model costs out things such as cable lengths and sizes, supporting structure types, cross box sizes, DLC equipment, and remote terminal enclosure types and sizes. The link cost calculator has “look up” tables that contain installed per foot costs for all the cable types and sizes used in the redesign of the routes. Along with that, it has tables indicating the installed costs for poles, conduit, terminals, drop wire and other equipment, such as the installed costs for various types of DLC equipment.

To produce an average forward looking link cost for a feeder route, various types of equipment are used as inputs. These inputs include cable lengths and sizes, supporting structure types, and other items listed previously. The “Calculator” then takes these inputs and multiplies the quantities of equipment by their installed unit costs to obtain dollar investments by category of equipment. Equipment capacities and utilization rates are used to convert the dollar investments into dollar investments per working pair.

The dollar investments per working pair are multiplied by their account specific ACFs and then summed across the equipment categories to obtain the average link cost for the feeder route. These loop costs are broken down into density zones and are also given for the state as a whole. The model accomplishes this by associating each of the 242 feeder routes with one of the three density zones based on the wire center to which it belongs. The cost for each feeder route is multiplied by the total working access lines in that route, and these weighted costs are added together for each density zone and divided by the total working access lines in that zone. A similar approach is followed to compute a statewide average.

The Link cost calculator includes the following investment when it produces loop cost studies; Copper sub-feeder and distribution cable, fiber optic feeder cable, remote terminal equipment, cross-boxes and distribution terminals, central office DLC termination electronics, DSX-1s and MDFs, NIDs, and Loop Structure (i.e. poles, conduits, and other supporting facilities). Using a costing tool developed to provide OSP planners with the ability to compile material and labor costs for an internal project or external customer sales request, forward looking investments for fiber cable, copper cable, SAI, service wire, distribution terminals, poles, and installation and engineering can be determined. Material prices for electronic equipment and cables reflect the latest negotiated contract prices Verizon has with the manufacturers of the circuit equipment and cable facilities, including applicable vendor discounts.

The model also uses a system known as ECRIS. This is a system used by OSP engineers to automate the costing scheduling, and tracking of OSP work. ECRIS permits engineers to build complex OSP jobs from elemental work operations. ECRIS calculates the cost of performing a work operation (“WKOP”), based on specific information about the WKOP provided by the user. A WKOP was built using ECRIS for placing and splicing cables of various

types, sizes, and lengths throughout the state. The total costs of these work operations are divided by the lengths of cable placed to obtain the installed costs per foot used by the link cost calculator. A similar methodology is used for cross-boxes, terminals, and poles.

The Link cost calculator addresses structure investments by assigning these investments (i.e., investment in poles, conduit, and other structure support facilities) directly to the loop along with the investment in loop cable and electronics. Structure costs are computed on a per pair foot basis and the resulting factors are multiplied by the number of pair feet of cable. This approach appropriately allocates total structure cost to the loop and transport elements based on the number of pair feet of cable supported for each element and prevents double recovery of structure investments.